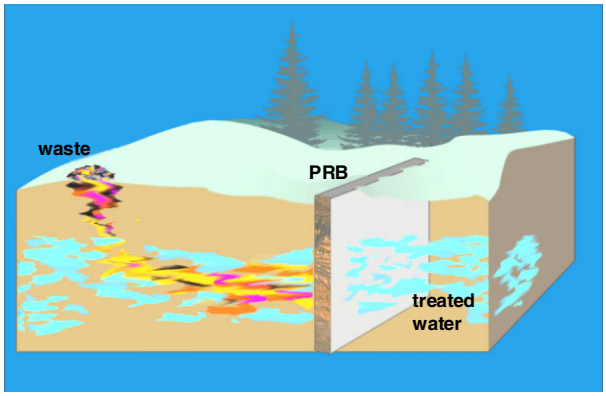

Project Title: **"Application of the Permeable Reactive Barrier Technology for the Treatment of Arsenic in Ground Water"**

Investigators: Richard Wilkin (U.S. EPA, Office of Research and Development, National Risk Management Research Laboratory, GWERD, Ada, OK 74820; 580-436-8874)

Collaborators: U.S. EPA Region 8

Background: This project explores passive treatment of arsenic contaminated ground water using a permeable reactive barrier (PRB). Current concentrations of arsenic in the ground water near a former metal-smelting facility are up to 5,000 times the drinking water standard of 10 parts per billion. Through application of this technology, it may be possible to restore the aquifer to drinking water standards. The advantages of permeable reactive barrier technology are that contaminant remediation occurs in situ, remediation is passive, and there is no ongoing energy input following installation. Additionally, a passive system eliminates the generation of arsenic-laden hazardous waste from conventional treatment processes.

Objectives: The overall goals of the research are to test the performance of the PRB technology for the treatment of arsenic contamination in ground water, to better understand the chemical processes that result in arsenic removal in a PRB, and to evaluate the impact of the PRB on the adjacent aquifer chemistry and hydrology. There is a continuing need to evaluate cost-effective remedial alternatives to pump-and-treat designs for cleaning-up ground water impacted by inorganic contaminants. A permeable reactive barrier is an emplacement of reactive materials in the subsurface designed to intercept a contaminant plume, provide a flow path through the reactive media, and transform the contaminant(s) into environmentally acceptable forms to attain remediation concentration goals at some point downgradient of the reactive barrier. In the case of inorganic species such as arsenic, the design objective of such an installation is to drive adsorption or precipitation reactions that result in the formation of less soluble and less mobile forms in the subsurface reactive media.

Approach: This project includes both field and laboratory research components. Field components involve hydrogeological and geochemical studies to obtain the information needed to select an appropriate design configuration and to evaluate the performance of a pilot-scale subsurface permeable reactive barrier to remediate arsenic-contaminated ground water. The target date for PRB installation is March 2004. Monitoring studies will be carried out for two years following installation on a quarterly basis. Hydrogeological studies before and after PRB installation will implement an electromagnetic borehole flowmeter to evaluate spatial variability of hydraulic conductivity, pneumatic slug-tests to evaluate bulk hydraulic conductivity, and conservative tracer studies. Geochemical studies will include the deployment and analysis of a series of multi-level samplers to determine vertical variability in ground-water chemistry, conventional low-flow ground-water sampling and analysis, and solid-phase characterization investigations that parallel those used in related in-house research projects. In addition, laboratory batch and column tests using reactive media will be conducted to determine the effectiveness of reactive materials such as zero-valent iron to treat site ground-water. Arsenic removal mechanisms will be identified by careful water chemistry, geochemical modeling, and solid-phase characterization studies.

Accomplishments: Completed initial field characterization of site

Su, C. and Wilkin, R.T. (2003). Arsenic interaction with iron(II,III) hydroxycarbonate green rust: Implications for arsenic remediation. Submitted to Fourth International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA).

Lien, H. and Wilkin, R.T. (2003). Zero-valent iron for high-level arsenite removal. Submitted to American Chemical Society Annual Meeting (Sept. 8-11, New York, NY).